CONTAINER WITH CAP RETAINER

Related Applications

[0001] This invention claims the benefit of the priority of Canadian patent application No. 2,442,519 (filed 23 September 2003) and Canadian patent application No. 2,450,477 (filed 18 November 2003).

Technical Field

[0002] This invention relates to containers having reusable caps. Particular embodiments of the invention provide containers having cap retainers on their walls and/or bases. After the containers are opened, the caps may be stored in the cap retainers and later reused to seal the containers.

Background

[0003] Figure 1A depicts a prior art beverage container 10. Container 10 comprises a container wall 12 and a base 13. Container 10 also comprises a rim 14, which defines a container opening 16. Opening 16 may be used to insert contents into and dispense contents from container 10. Typically, rim 14 and opening 16 are circularly shaped. Typically, container 10 will comprise a cap 18 as shown in more detail in Figures 1B and 1C.

[0004] Figures 1B and 1C depict a reusable cap **18** for sealing and resealing container **10**. Cap **18** comprises a top portion **20** having an exterior surface **20A** and an interior surface **20B** and a side portion **22** having an exterior surface **22A** and an interior surface **22B**. Side portion **22** of cap **18** comprises a cap rim **23**, which defines a cap opening **25**. In the particular container **10** of Figures 1A-1C, container **10** is sealed by extending rim **14** of container **10** into cap opening **25** and rotating container **10** and cap **18** relative to one another, such that one or more threads **24** located on rim **14** of container **10** engage corresponding thread(s) **26** on cap **18**. When cap **18** is coupled to container **10** in this manner, the contents of container **10** are prevented from escaping.

[0005] When a cap is uncoupled from its container, the cap is separated from the container and may become lost, dirty or otherwise contaminated. In addition, it is often inconvenient to have to hold the cap in one hand while using the other hand to hold the container and dispense the container's contents. For example, in the case of a beverage container, after removing the cap from the container it is necessary to use at least one hand to drink from the container opening. If a person needs to use

their other hand for another activity (e.g. riding a bicycle, driving a car, holding onto a handbag or the like), then the person typically must put the cap down as both their hands are in use. Often, putting the cap down is done absent mindedly, which may cause the cap to become lost. Sometimes, there is no hygienic place to put the cap down and the cap can become dirty or otherwise contaminated. In addition, some of the container contents may be present on the cap and may dirty, stain or damage the material onto which the cap is placed.

[0006] Attempts to solve these problems have been devised, which include attaching the cap permanently to the container by a wire, chain or plastic tether. However, attaching the cap to the container in this manner has a number of drawbacks. When the cap is removed from the container, the cap dangles from its tether. Contents from the container which are present on the dangling cap may drip from the dangling cap. The dangling cap may also become an inconvenient obstacle for inserting contents into and withdrawing contents from the container. Moreover, the dangling cap is completely exposed to the outside environment and may become dirty or otherwise contaminated.

[0007] United States Patent No. 5,211,299 (Manfredonia) discloses a baby bottle formed with a truncated conical cap which includes an annular groover adjacent to its top wall. A bottom of the baby bottle incorporates a truncated conical cavity directed coaxially into the bottle for receiving the cap. The walls of the cavity are formed with a plurality of projections for projecting into the annular groove in the cap. The Manfredonia bottle is unhygienic because when the cap is received in the stored position, its rim and its interior surfaces are still exposed to contamination. In addition, a person must grasp the interior surfaces of the cap to insert and/or remove the cap from the cavity. Another drawback with the Mandfredonia technique involves the difficulty of fabricating the bottle and cap using conventional molding techniques.

[0008] United States patent No.'s 5,897,010 and 6,131,755 (Soyka Jr. et al.) disclose a number of bottle assemblies having corresponding cap retention portions which are adapted to allow removable storage of their bottle caps. The Soyka Jr. et al. embodiments where the rim of the cap fits over a protruding cap retention portion are unhygienic because the surfaces of the protruding cap retention portion may become dirty during handling of the bottle. It is also easy for the cap to be accidentally knocked off of the protruding cap retention portion. The Soyka Jr. et

al. embodiments where the cap fits into a depressed cap retention portion are disadvantageous, because it is difficult to insert the cap into and remove the cap from the cap retention portion that completely encircles the cap. These difficulties are exacerbated in the Soyka Jr. et al. embodiment having inwardly extending shoulders at the entrance to the cap retention portion. For the same reasons as discussed above with respect to Manfredonia, it is unhygienic to insert the cap into the depressed cap retention portion with the top portion of the cap being deepest in the depression as described in Soyka Jr. et al. In addition, the shoulders described by Soyka Jr. et al. may make it difficult to mold the Soyka Jr. depressed cap retention portion and may also make it difficult to deform the cap in a manner which facilitates easy insertion and removal thereof.

[0009] There is a general desire to provide containers having cap retainers, so that their caps may be stored and later reused in a manner which overcomes or ameliorates some of the drawbacks associated with the prior art.

Summary of the Invention

[0010] One particular aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a slot defined by a pair of sidewalls. The slot has at least one open end. Each of the sidewalls provides a contact surface which engages the cap for securing the cap in its storage configuration within the slot. The slot may be formed in a side wall or in the base of a container.

[0011] The cap may be slidable in a direction of a longitudinal dimension of the slot from the at least one open end of the slot to its storage configuration. The contact surfaces of the sidewalls may engage an exterior surface of a side portion of the cap. The cap may be secured in its storage configuration by frictional forces between the contact surfaces and the exterior surface of the side portion of the cap. The cap may be additionally or alternatively secured in its storage configuration by pressure associated with elastic deformation of the cap or the sidewalls.

[0012] Each of the sidewalls may comprise at least one sidewall point, where the sidewall extends transversely into the slot. The transverse dimension of the slot is narrower in a region of the at least one sidewall point when compared to the

transverse dimension of the slot in a region of the contact surfaces. For each sidewall, the at least one sidewall point may be located between the at least one open end of the slot and the contact surface of the sidewall. The at least one sidewall point for a first of the sidewalls and the at least one sidewall point for a second of the sidewalls may be located directly, transversely across the slot from one another. The sidewalls may each comprise a pair of sidewall points and the contact surface of each sidewall may be located between its pair of sidewall points. The sidewalls may each comprise a plurality of sidewall points and a plurality of contact surfaces and each contact surface may be located between a pair of sidewall points.

[0013] The contact surfaces may be curved to correspond to a shape of the side portion of the cap. The curved contact surfaces may exert pressure on the cap such that the side portion of the cap is deformed to conform to the shape of the curved contact surfaces.

[0014] The cap retainer may comprise a wall which extends transversely between the sidewalls at one end of the slot. The transversely extending wall may comprise an additional contact surface which engages the cap for securing the cap in its storage configuration. The contact surfaces of the sidewalls and the contact surface of the transversely extending wall may be curved to correspond to a shape of the side portion of the cap.

[0015] The sidewalls may comprise an outwardly opening tapering angle in a range of 0-5°.

[0016] The cap may comprise a lip which projects radially outwardly from its side portion and each of the sidewalls may comprise a corresponding groove for receiving the cap when the cap is in its storage configuration.

[0017] The sidewalls may extend inwardly from a container wall and a base of the slot may be depressed relative to the container wall. Alternatively, the sidewalls may extend outwardly from a container wall and a base of the slot may be level with the container wall.

[0018] At least one of the contact surfaces of the sidewalls and the exterior surface of the side portion of the cap may be coated with a layer of an elastomeric material. The cap may be secured in its storage configuration by frictional forces between the layer of elastomeric material and the contact surfaces or between the layer of elastomeric material and the exterior surface of the side portion of the cap. The cap may be secured in its storage configuration by pressure associated with elastic deformation of the elastomeric material.

[0019] Another aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a circularly shaped depressed region for receiving the cap. The depressed region is located between a plurality of lobes which are angularly spaced apart around a circumference thereof. Each of the lobes comprises a contact surface which engages the cap for securing the cap in its storage configuration. The container comprises channels between each of the lobes for permitting finger access to remove the cap from its storage configuration. Each of the contact surfaces may comprise an outwardly opening tapering angle in a range of 0-5°.

[0020] Another aspect of the invention provides a container having a container opening and a reusable cap for sealing the container opening. The container comprises a cap retainer for storing the cap in a storage configuration when the cap is not being used to seal the opening. The cap retainer comprises a circularly symmetric depressed region for receiving the cap. A side portion of the cap comprises one or more radially extending projections, each projection spanning an arcuate segment of a circumference of the side portion of the cap. Each of the radially extending projections engages a corresponding contact surface of the circularly symmetric depressed region for securing the cap in its storage configuration.

[0021] Another aspect of the invention provides a container comprising an opening, a reusable cap engageable with the opening and a cap retainer. The cap retainer comprises a pair of opposed sidewalls defining a slot having at least one open end. The slot comprises a cap receiving area and a narrowed throat located between the cap receiving area and the at least one open end. The narrowed throat has a transverse dimension smaller than a transverse dimension of the cap and

smaller than a transverse dimension of the cap receiving area. Each of the sidewalls also comprises a contact surface which engages the cap when the cap is located in the cap receiving area for securing the cap therein.

[0022] Further features and applications of specific embodiments of the invention are described below.

Brief Description of the Drawings

[0023] In drawings which depict non-limiting embodiments of the invention:

Figure 1A is a side elevation view of a prior art beverage container;

Figure 1B and 1C are respectively isometric and cross-sectional views of a prior art cap for the container of Figure 1A;

Figures 2A-2C are respectively a side elevation view, a partially sectioned side view (along axis A-A) and a cross-sectional view (along axis B-B) of a container according to an embodiment of the invention with its cap stored in its cap retainer;

Figure 2D is a side elevation view of the cap retainer of the container of Figures 2A-2C;

Figures 3A-3C are respectively a side elevation view, a partially sectioned side view (along axis C-C) and a cross-sectional view (along axis D-D) of a container according to another particular embodiment of the invention with its cap stored in its cap retainer;

Figure 3D is a side elevation view of the cap retainer of the container of Figures 3A-3C;

Figures 4A-4C are respectively a side elevation view, a partially sectioned side view (along axis E-E) and a cross-sectional view (along axis F-F) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

Figure 4D is a side elevation view of the cap retainer of the container of Figures 4A-4C;

Figures 5A-5C are respectively a side elevation view, a partially sectioned side view (along axis G-G) and a cross-sectional view (along axis H-H) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

Figures 6A-6B are respectively a partially sectioned side view (along axis I-I) and a cross-sectional view (along axis J-J) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

Figures 7A-7B are respectively a partially sectioned side view (along axis K-K) and a cross-sectional view (along axis L-L) of a container according to another embodiment of the invention with its cap stored in its cap retainer;

Figures 8A-8B are respectively a partially sectioned side view (along axis M-M) and a bottom view of container according to another embodiment of the present invention with its cap stored in its cap retainer;

Figures 9A and 9B are respectively a partially sectioned side view (along line N-N) and a cross-sectional view (along line O-O) of a container according to another embodiment of the present invention with its cap stored in its cap retainer;

Figures 9C and 9D are respectively a cross-sectional view (along line P-P) and a bottom view of the cap for the container of Figures 9A and 9B;

Figures 10A and 10B are respectively a partially sectioned side view (along line Q-Q) and a bottom view of a container according to another embodiment of the present invention with its cap stored in its cap retainer; and

Figures 11A and 11B are respectively a partially sectioned side view (along line R-R) and a bottom view of a container according to another embodiment of the present invention with its cap stored in its cap retainer.

Detailed Description

[0024] Throughout the following description, specific details are set forth in order to provide a more thorough understanding of the invention. However, the invention may be practiced without these particulars. In other instances, well known elements have not been shown or described in detail to avoid unnecessarily obscuring the invention. Accordingly, the specification and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0025] Some embodiments of the invention provide containers having removable caps and cap retainers. The caps may be removed from the container openings, stored in the cap retainers and later reused to seal the containers. Some embodiments of the invention provide containers for storing beverages or other edible fluids, commonly referred to as "bottles". In preferred embodiments of the invention, the cap retainers allow the caps to be stored in a hygienic manner that minimizes the opportunities of contamination of the caps before they are used to reseal the containers.

[0026] A cap retainer comprises one or more contact surfaces which contact corresponding surface(s) of the cap to secure the cap in the cap retainer. The

contact surfaces may be part of a recessed region formed in the container wall or the container base. Alternatively, the contact surfaces may project outwardly from the container walls and/or the container base. The cap may be secured in the cap retainer by frictional forces acting between the contact surface(s) of the cap retainer and the corresponding surfaces of the cap. In some embodiments, the contact surface(s) of the cap retainer and/or the corresponding surface(s) of the cap are made of elastically deformable material and/or are covered in a layer of elastomeric material. In such embodiments, the cap may be additionally secured in the cap retainer by pressure exerted between the contact surface(s) and the cap as a result of elastic deformation of the cap, the cap retainer and/or the elastomeric material.

[0027] Figures 2A-2D depict a container **100** having a cap **103** and a cap retainer **110** according to one embodiment of the invention. Container **100** is a bottle for holding a beverage. Container **100** comprises a container wall **101**, a base **105** and a generally circular rim **102** which defines container opening **102A**. Cap **103** may be substantially similar to prior art cap **18** described above. Cap **103** may be coupled to rim **102** to seal opening **102A**. In the illustrated embodiment, cap **103** is threadably coupleable to rim **102**. In Figures 2A-2C, cap **103** is shown in its storage configuration, wherein cap **103** is retained in cap retainer **110**.

[0028] Cap retainer **110** comprises an elongated slot **110A** formed between a pair of sidewalls **114, 115**. At one of its ends, slot **110A** comprises a wall **113** which extends transversely between sidewalls **114, 115** and at its opposing end **111**, slot **110A** is open. In the illustrated embodiment, as seen best in Figures 2B and 2C, slot **110A** and its base **116** are recessed into container wall **101**. In alternative embodiments, sidewalls **114, 115** and lower wall **113** may extend outwardly from container wall **101**, such that base **116** of slot **110A** is level with container wall **101**.

[0029] In the illustrated embodiment, sidewalls **114, 115** and transverse wall **113** have a shape shown best in Figure 2D. At the open end **111** of slot **110A**, the transverse dimension of slot **110A** is relatively wide (i.e. sidewalls **114, 115** are relatively widely spaced apart from one another). As sidewall portions **114A, 115A** extend away from open end **111** and toward transverse wall **113**, the transverse dimension of slot **110A** narrows. In the illustrated embodiment, sidewall portions **114A, 115A** are generally planar angled surfaces. Sidewall portions **114A, 115A**

may also be curved. The transverse dimension of slot **110A** is narrowest at sidewall points **114B, 115B**. In some embodiments, sidewall points **114B, 115B** may extend inwardly by a distance in a range of 0-5% of the diameter of cap **103**.

[0030] As sidewall portions **114C, 115C** extend below sidewall points **114B, 115B** toward transverse wall **113**, the transverse dimension of slot **110A** increases again. Sidewall portions **114C, 115C** and portion **113A** of transverse wall **113** are shaped to provide a curved cap retaining bay **117**. The contact surfaces of cap retaining bay **117** may be shaped correspond generally to exterior surface **146** of side portion **146A** of cap **103**. In some embodiments, the contact surfaces of cap retaining bay **117** may exert pressure on cap **103**, such that side portion **146A** of cap **103** is deformed to conform to the shape of the curved surfaces of cap retaining bay **117**.

[0031] Putting cap **103** into its storage configuration in cap retainer **110** first involves placing cap **103** into slot **110A** at its open upper end **111**. Preferably, a portion of cap **103** abuts against base **116** of slot **110A**. Cap **103** may then be slid along the longitudinal dimension of slot **110A** until it passes sidewall points **114B, 115B** (i.e. the narrowest portion of slot **110A**) and fits into retaining bay **117**. Sliding cap **103** past sidewall points **114B, 115B** preferably involves some deformation of cap **103** and/or sidewalls **114, 115**, such that when cap **103** is slid into retaining bay **117**, the person placing cap **103** into cap retainer **110** hears and/or feels a "click" as cap **103** and/or sidewalls **114, 115** expand back toward their nominal (i.e. undeformed) configuration.

[0032] When cap **103** is received in retaining bay **117**, it is in its storage configuration. Surfaces **114C, 115C, 113A** of retaining bay **117** represent the contact surfaces of cap retainer **110**, which contact the exterior surface **146** of side portion **146A** of cap **103**. Cap **103** is secured in place in its storage configuration by frictional forces acting between contact surfaces **114C, 115C, 113A** of cap retainer **110** and the exterior surface **146** of side portion **146A** of cap **103**. Preferably, when cap **103** is in its storage configuration, there is still some deformation of side portion **146A** of cap **103** and/or contact surfaces **114C, 115C, 113A** of cap retainer **110**. Such elastic deformation causes pressure to be exerted between contact surfaces **114C, 115C, 113A** of cap retainer **110** and the exterior

surface **146** of side portion **146A** of cap **103**. This pressure tends to hold cap **103** in place in cap retainer **110**.

[0033] Preferably, as shown in Figures 2A-2C, cap **103** is inserted and stored into cap retainer **110** in an orientation wherein cap rim **118** (Figures 2B, 2C) abuts against base **116** of slot **110A** and the exterior surface **145** of top portion **145A** of cap **103** is facing outwardly. This orientation of cap **103** in cap retainer **110** promotes hygiene by minimizing the exposure of the cap opening and the interior surfaces of cap **103** to contamination. In addition, a person may insert and remove cap **103** from cap retainer **110** without handling the interior surfaces of cap **103**. Another benefit with this orientation is that less force is required to deform cap **103** when inserting it into cap retainer **110**, as only the side portion **146A** of cap **103** needs to be deformed and the top portion **145A** of cap **103** need not be deformed. In some embodiments, only the region of side portion **146A** closest to cap rim **118** need be deformed to insert cap **103** into cap retainer **110**. Those skilled in the art will appreciate that the region of side portion **146A** closest to cap rim **118** is more easily deformable than the region of side portion **146A** closest to top portion **145A**. This orientation of cap **103** in cap retainer **110** also helps to prevent cap **103** from being permanently warped or broken because of excessive deformation.

[0034] Removal of cap **103** from cap retainer **110** may be accomplished in a manner opposite to that of insertion, wherein cap **103** is forced toward open end **111** of slot **110A** and is subsequently removed from slot **110A**. Alternatively, cap **103** may be pulled directly outwardly from slot **110A** without having to slide cap **103** toward open end **111**.

[0035] Sidewalls **114, 115** and/or transverse wall **113** may optionally be provided with a non-zero tapering angle β (Figure 2C), such that the transverse dimension of slot **110A** gets wider as sidewalls **114, 115** and/or transverse wall **113** extend away from base **116** of slot **110A**. As shown in Figure 2C, tapering angle β is measured from a plane orthogonal to base **116** of slot **110A**. When cap **103** is inserted into slot **110A** in the orientation discussed above, tapering angle β causes the most deformation to occur in the region of side portion **146A** closest to cap rim **118**. As discussed above, it is easier to deform the region of side portion **146A** closest to cap rim **118** than the region of side portion **146A** closest to top portion **145A**. Deforming this portion of cap **103** also helps to prevent cap **103** from being

permanently warped or broken because of excessive deformation. Tapering angle β may be selected on the basis of the elastic deformation properties and friction properties of the materials used for cap **103** and cap retainer **110**, such that cap **103** is adequately secured in cap retainer **110** without permanently warping or breaking cap **103**. In some embodiments, tapering angle β is in the range of 0-5°. Tapering angle β may be significantly increased by coating the exterior surface **146** of side portion **146A** of cap **103** and/or contact sufaces **114C**, **115C**, **113A** with elastomeric material that increases the friction therebetween. This provides additional freedom for design and fabrication of container **100** and cap **103**.

[0036] Figures 3A-3D show a container **200** and cap **203** according to another embodiment of the invention. In many respects, container **200** and cap **203** are similar to container **100** and cap **103** of Figures 2A-2D. Features of container **200** and cap **203** that are similar to features of container **100** and cap **103** are provided with similar reference numerals preceded by the digit "2" rather than "1".

[0037] One difference between container **200** and container **100** is that cap retainer **210** of container **200** comprises a slot **210A** having a pair of open ends **211**, **212** (i.e. transverse wall **113** is not present in cap retainer **210** of container **200**). Sidewalls **214**, **215** of cap retainer **210** also have different shapes than sidewalls **114**, **115** of cap retainer **110**. As shown best in Figure 3D, sidewall portions **214A**, **215A** closest to open end **211** are shaped such that the transverse dimension of slot **210A** becomes narrower as sidewall portions **214A**, **215A** extend away from open end **211**. Similarly, sidewall portions **214E**, **215E** closest to open end **212** are shaped such that the transverse dimension of slot **210A** becomes narrower as sidewall portions **214E**, **215E** extend away from open end **212**. In the illustrated embodiment, sidewall portions **214A**, **215A**, **214E**, **215E** are planar angled surfaces, but sidewall portions **214A**, **215A**, **214E**, **215E** may also be curved.

[0038] Slot **210A** is narrowest at sidewall points **214B**, **215B** and at sidewall points **214D**, **215D**. In some embodiments, sidewall points **214B**, **215B**, **214D**, **215D** may extend inwardly by a distance in a range of 0-5% of the diameter of cap **203**. As sidewalls **214**, **215** extend downwardly from sidewall points **214B**, **215B** and upwardly from sidewall points **214D**, **215D**, sidewall portions **214C**, **215C** are shaped such that the dimension of slot **210A** increases again. Sidewall portions **214C**, **215C** may be curved to correspond in shape to side portion **246A** of cap **203**.

In some embodiments, sidewall portions **214C**, **215C** exert pressure on cap **203**, such that side portion **246A** of cap **203** is deformed to conform to the shape of the curved surfaces of sidewall portions **214C**, **215C**.

[0039] Cap **203** may be inserted and stored in cap retainer **210** from either open end **211**, **212** of slot **210A**. When inserting cap **203** into slot **210A**, a portion of cap **203** preferably abuts against base **216** of slot **210A**. Cap **203** is then slid along the longitudinal dimension of slot **210A** until it passes sidewall points **214B**, **215B** (when inserted from open end **211**) or until it passes sidewall points **214D**, **215D** (when inserted from open end **212**). Cap **203** is in its storage configuration when it reaches sidewall portions **214C**, **215C**. Sliding cap **203** past sidewall points **214B**, **215B** or sidewall points **214D**, **215D** preferably involves some deformation of cap **203** and/or sidewalls **214**, **215**, such that when cap **203** reaches sidewall portions **214C**, **215C**, the person placing cap **203** into cap retainer **210** hears and/or feels a "click" as cap **203** and/or sidewalls **214**, **215** expand back toward their nominal (i.e. undeformed) configuration.

[0040] Surfaces **214C**, **215C** represent the contact surfaces of cap retainer **210**, which contact the exterior surface **246** of side portion **246A** of cap **203**. As with cap retainer **110**, cap **203** is secured in place in the storage configuration by frictional forces acting between contact surfaces **214C**, **215C** of sidewalls **214**, **215** and or the pressure associated with the elastic deformation of sidewalls **114**, **115** and/or cap **203**. For the reasons discussed above in relation to container **100** and cap **103**, it is preferable that cap **203** be inserted into cap retainer **210** in such a manner that the cap rim **218** faces base **216** of slot **210A** and exterior surface **245** of top portion **245A** faces outwardly.

[0041] Removal of cap **203** from cap retainer **210** may be accomplished in a manner opposite that of insertion, wherein cap **203** is forced toward either open end **211**, **212** of slot **210A** and is subsequently removed from slot **210A**. Alternatively, cap **203** may be pulled directly outwardly from slot **210A** without having to slide cap **203** toward open end **211** or open end **212**.

[0042] Figures 4A-4D show a container **300** and a cap **303** according to another embodiment of the invention. In many respects, container **300** and cap **303** are similar to container **200** and cap **203** of Figures 3A-3D. Features of container

300 and cap **303** that are similar to features of container **200** and cap **203** are provided with similar reference numerals preceded by the digit "3" rather than "2".

[0043] One difference between container **300** and container **200** is the shape of sidewalls **314, 315** in cap retainer **310** which comprise narrowing portions **314A, 315A** (proximate to open end **311**), narrowing portions **314I, 315I** (proximate to open end **312**), multiple sidewall points **314B, 315B; 314D, 315D; 314F, 315F**; and **314H, 315H**, and multiple curved contact surfaces **314C, 315C; 314E, 315E**; and **314G, 315G**, between which cap **303** may be retained. Those skilled in the art will appreciate that any pair of the multiple contact surfaces **314C, 315C; 314E, 315E**; or **314G, 315G** may be used to retain cap **303**. Accordingly, cap retainer **310** provides a plurality of potential storage configurations for cap **303**. Those skilled in the art will also appreciate that cap retainer **310** is shown with three pairs of contact surfaces **314C, 315C; 314E, 315E**; and **314G, 315G**, but that cap retainer **310** may have larger number or smaller number of pairs of contact surfaces and a correspondingly larger or smaller number of storage configurations for cap **303**. Providing multiple storage configurations is advantageous because, if a user accidentally slides cap **303** too far into slot **310A** and cap **303** slides past a first pair of contact surfaces (e.g. contact surfaces **314C, 315C**), then cap **303** may still be retained between another pair of contact surfaces (e.g. contact surfaces **314E, 315E**).

[0044] Another difference between container **300** and cap **303** in comparison to the previously described embodiments is that cap **303** comprises an optional lip **320** which projects radially outwardly from side portion **346A** of cap **303** near cap rim **318**. Sidewalls **314, 315** comprise corresponding grooves **321** for receiving lip **320** when cap **303** is inserted into slot **310A**. Lip **320** and corresponding grooves **321** help to retain cap **303** in cap retainer **310**. When cap **303** is inserted into slot **310A**, lip **320** projects into grooves **321** such that it is more difficult to dislodge cap **303** directly outward from slot **310A**. In addition, lip **320** of cap **303** and grooves **321** of container **300** may allow for slot **310A** to have a relatively shallow shape.

[0045] Another difference between container **300** and container **200** is that cap retainer **310** of container **300** has a base **316** which is substantially planar from open end **311** through to open end **312**. In contrast, as shown best in Figure 3B, cap retainer **210** comprises a curved base portion **219** near open end **212**. Curved base

portion **219** may make it easier to guide cap **203** into cap retainer **210**. Those skilled in the art will appreciate that any of the slotted embodiments described herein may comprise curved base portions at one or both of their open ends. Container **300** also differs from container **200** in that open end **312** of cap retainer **310** extends all the way to the bottom of wall **301** of container **300** (i.e. open end **312** opens onto base **305** of container **300**). Those skilled in the art will appreciate that any of the cap retaining slots described herein may have one of their open ends extend to the base of its corresponding container.

[0046] Figures 5A-5C depict a container **400** and its cap **403** according to another embodiment of the invention. In many respects, container **400** and cap **403** are similar to the previously described containers and caps. Features of container **400** and cap **403** that are similar to features of container **100** and cap **103** are provided with similar reference numerals preceded by the digit "**4**" rather than "**1**".

[0047] One difference between container **400** and the containers of the previously described embodiments is that cap retainer **410** comprises sidewalls **414**, **415**, which extend outwardly from container wall **401** (i.e. rather than being depressed into container wall **401**). Sidewalls **414**, **415** form a slot **410A** having a base **416** that is level with container wall **401** rather than being depressed in container wall **401**.

[0048] Sidewalls **414**, **415** extend substantially vertically along container wall **401** and are divided into upper portions **414A**, **415A** and lower portions **414B**, **415B** separated by gaps **426**, **427**. Sidewalls **414**, **415** are straight; however, those skilled in the art will appreciate that sidewalls **414**, **415** may be provided with shapes similar to those of sidewalls **114**, **115**, sidewalls **214**, **215** or sidewalls **314**, **315** having one or more sidewall point(s) and/or curved sidewall contact portion(s). Slot **410A** comprises upper open end **411** and lower open end **412**. Those skilled in the art will appreciate that slot **410A** may be provided with a transverse wall similar to transverse wall **113**, except that the transverse wall of slot **410A** would extend outwardly from container wall **401**.

[0049] Cap **403** comprises a radially outwardly extending lip **420** similar to lip **320** of cap **303** (Figures 4A-4D) and sidewalls **414**, **415** of slot **410A** comprise

corresponding grooves **421** similar to grooves **321** of sidewalls **314**, **315** of slot **310A** (Figures 4A-4D). When cap **403** is inserted into slot **410A**, lip **420** projects into grooves **421**, such that cap **403** is retained in cap retainer **410**. Those skilled in the art will appreciate that lip **420** and corresponding grooves **421** are optional and that cap **404** may be retained in cap retainer by frictional forces between sidewalls **414**, **415** and exterior surface **446** of side portion **446A** of cap **403** and/or pressure associated with elastic deformation of sidewalls **414**, **415** and/or cap **403**. For example, the interior lower corners of sidewall portions **414A**, **415A** and the interior upper corners of sidewall portions **414B**, **415B** may act as contact surfaces which engage the exterior surface **446** of side portion **446A** to create friction and/or deformation.

[0050] As shown best in Figure 5C, container **400** comprises a plurality of outwardly extending sidewalls to provide an optional plurality of cap retainers **410**, **430**, **440**, **450**, **460**. Cap retainers **430**, **440**, **450**, **460** are substantially similar to cap retainer **410**. Those skilled in the art will appreciate that container **400** may provide any practical number of cap retainers.

[0051] Figures 6A-6B illustrate a container **500** and its cap **503** according to yet another embodiment of the invention. Although cap retainer **510** is located on base **505** of container **500** (rather than on container wall **501**), container **500** and cap **503** are similar in many other respects to the previously described containers and caps. Features of container **500** and cap **503** that are similar to features of container **100** and cap **103** are provided with similar reference numerals preceded by the digit "5" rather than "1".

[0052] Container **500** differs from the embodiment previously described in that cap retainer **510** comprises a generally circularly symmetric depressed region **510A** (rather than an elongated slot), which is located in base **505** of container **500** (rather than in container wall **501**). Depressed region **510A** may be formed between a plurality of lobes **531**, which extend inwardly from a perimeter of base **505**. In the illustrated embodiment, lobes **531** comprise bottom surfaces which, together with perimeter region **507** of base **505**, allow container **510** to stand upright on a flat surface. In the illustrated embodiment, container **500** comprises three lobes **531** evenly spaced apart around the circularly symmetric shape of depressed region **510A**. In general, the number of lobes **531** may vary, provided that there are one or

more lobes **531**. In addition, although lobes **531** are preferably evenly spaced about depressed region **510A**, this is not a requirement.

[0053] Cap **503** is inserted directly inwardly into depressed region **510A**. A person simply pushes cap **503** into depressed region **510A** between lobes **531**. Alternatively, if cap **503** is located on a surface, a person may place container **500** over cap **503**, such that cap **503** is aligned with depressed region **510A** and the surface pushes cap **503** into depressed region **510A**.

[0054] When cap **503** is located in depressed region **510A**, cap **503** is in its storage configuration. The innermost surfaces **531A** of lobes **531** define the circularly symmetric shape of depressed region **510A**, which may correspond to the shape of cap **503**. The innermost surfaces **531A** of lobes **531** form contact surfaces, which engage outer surface **546** of side portion **546A** of cap **503** to retain cap **503** in its storage configuration. Cap **503** is retained in its storage configuration by frictional forces existing between contact surfaces **531A** and outer surface **546** of side portion **546A** of cap **503**. In addition, cap **503** may be maintained by the pressure associated with the elastic deformation of cap **503** and/or lobes **531**. In such embodiments, the contact surfaces **531A** of cap retainer **510** may exert pressure on cap **503**, such that side portion **546A** of cap **503** is deformed as shown in Figure 6B. As shown in Figure 6B, the radius of side portion **546A** of cap **503** may contract in the region of contact surfaces **531A** and may expand in the regions of gaps **533**.

[0055] Preferably, as shown in Figures 6A-6B, cap **503** is inserted into cap retainer **510** with its cap rim **518** facing into depressed region **510A** and the exterior surface **545** of its top portion **545A** facing downwardly. This orientation of cap **503** in cap retainer **510** promotes hygiene by minimizing the exposure of the cap opening and the interior surfaces of cap **503** to contamination. In addition, a person may insert and remove cap **503** from cap retainer **510** without handling the interior surfaces of cap **503**. Another benefit with this orientation is that less force is required to deform cap **503** when inserting it into cap retainer **510**, as only the side portion **546A** of cap **503** needs to be deformed and the top portion **545A** of cap **503** need not be deformed. In some embodiments, only the region of side portion **546A** closest to cap rim **518** need be deformed to insert cap **503** into cap retainer **510**. Those skilled in the art will appreciate that the region of side portion **546A**

closest to cap rim **518** is more easily deformable than the region of side portion closest to top portion **545A**. This orientation of cap **503** in cap retainer **510** also helps to prevent cap **503** from being permanently warped or broken because of excessive deformation.

[0056] Cap retainer **510** also comprises a number of channels **533** located between lobes **531**. Channels **533** are preferably large enough such that a person may fit one or more fingers in channels **533**. Channels **533** permit a person to use their fingers to access cap **503** when it is stored in cap retainer **510** to facilitate removal of cap **503** therefrom. The person simply grasps side portion **546A** of cap **503** and pulls it directly outwardly from depressed region **510A**.

[0057] In the illustrated embodiment, lobes **531** each have a rounded surface **534** at the entrance to depressed region **510A** (see Figure 6A). Surface **534** helps to facilitate easy insertion of cap **503** into cap retainer **510**. In addition, the contact surfaces **531A** of lobes **531** are preferably provided with a tapering angle α (see Figure 6A), such that the dimension between contact surfaces **531A** narrows as contact surfaces **531A** extend deeper into recessed region **510A**. Tapering angle α is measured from a longitudinal axis of container **500**. When cap **503** is inserted into depressed region **510A** in the orientation discussed above, tapering angle α causes the most deformation to occur in the region of side portion **546A** closest to cap rim **518**. As discussed above, it is easier to deform the region of side portion **546A** closest to cap rim **518** than the region of side portion **546A** closest to top portion **545A**. Deforming this portion of cap **503** also helps to prevent cap **503** from being permanently warped or broken because of excessive deformation. Tapering angle α_1 may be selected on the basis of the elastic deformation properties and friction properties of the materials used for cap **503** and cap retainer **510**, such that cap **503** is adequately secured in cap retainer **510** without permanently warping or breaking cap **503**. In some embodiments, tapering angle α is in the range of 0-5°.

[0058] Figures 7A-7B depict a container **600** and its cap **603** according to yet another embodiment of the invention.. Container **600** and cap **603** are similar in many respects to container **500** and cap **503** described above. Features of container **600** and cap **603** that are similar to features of container **500** and cap **503** are provided with similar reference numerals preceded by the digit "**6**" rather than "**5**".

[0059] One difference between container **600** and container **500** is that base **605** of container **600** does not have a perimeter region **507** and that lobes **631** comprise flat bottom surfaces **609** for supporting container **600** in an upright position when it is resting on a surface. In addition, in the illustrated embodiment of Figures 7A-7B, cap retainer **610** comprises five lobes **631** instead of the three lobes **531** of container **500** of Figures 6A-6B. Those skilled in the art will appreciate, however, that cap retainers **510**, **610** may generally comprise different numbers of lobes **531**, **631**. Although lobes **631** are preferably evenly spaced about depressed region **610A**, this is not a requirement. Cap **603** is inserted and removed from cap retainer **610** in a manner similar to insertion and removal of cap **503** from cap retainer **510**. Cap **603** is retained in cap retainer **610** by frictional forces between contact surfaces **631A** of lobes **631** and outer surface **646** of side portion **646A** of cap **603** and/or by pressure associated with the deformation of cap **603** and/or lobes **631**. In such embodiments, the contact surfaces **631A** of cap retainer **610** may exert pressure on cap **603**, such that side portion **646A** of cap **503** is deformed as shown in Figure 7B. As shown in Figure 7B, the radius of side portion **646A** of cap **603** may contract in the region of contact surfaces **631A** and may expand in the regions of gaps **633**.

[0060] Figures 8A-8B depict a container **700** and its cap **703** according to yet another embodiment of the invention. Container **700** and cap **703** are similar in many respects to container **600** and cap **603** described above. Features of container **700** and cap **703** that are similar to features of container **600** and cap **603** are provided with similar reference numerals preceded by the digit "7" rather than "6".

[0061] One difference between container **700** of Figures 8A-8B and container **600** of Figures 7A-7B is that contact surfaces **731A** of lobes **731** of cap retainer **710** and/or outer surface **746** of side portion **746A** of cap **703** are coated with a layer **711** of elastomeric material. Layer **711** of elastomeric material may increase the friction between contact surfaces **731A** and outer surface **746** of side portion **746A** of cap **703**. In addition, layer **711** of elastomeric material may itself deform when cap **703** is inserted between lobes **731**, such that the pressure created by the deformation of layer **711** may tend to secure cap **703** in cap retainer **710**. For this reason, container **700** is particularly well suited for caps and/or containers fabricated from substantially non-deformable materials. Those skilled in the art will

appreciate that any of the embodiments described herein may make use of caps and/or container contact surfaces which have been coated with elastomeric material.

[0062] Containers according to any of the above described embodiments of the invention may be designed to hold pressurized or non-pressurized contents. Containers according to the various embodiments of the invention, may be made of relatively rigid material(s) such as hard plastic, glass or metal, or semi-rigid, elastically deformable materials, such as elastically deformable plastic. Suitable elastically deformable plastics include polyethylene terephthalate (PET) and high-density polyethylene (HDPE) for example. Different parts of the containers may comprise different materials. For example, any of the containers in accordance with the invention may comprise container walls made of a rigid metal, while the cap retainer may be made of a different rigid or semi-rigid material or may be coated with a layer of elastomeric material.

[0063] As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope thereof. For example:

- Figures 9A-9D show a container **800** and a cap **803** according to an alternative embodiment of the invention. Side portion **805** of cap **803** comprises one or more radially extending projections **807**, each of which spans an arcuate segment of the circumference of side portion **805**. In the illustrated embodiment, as shown best in Figure 9D, cap **803** comprises three circumferentially spaced apart, radially extending projections **807**. Projections **807** may be integrally formed with cap **803** or may be subsequently fused or otherwise added to cap **803**. In some embodiments, projections **807** comprise elastomeric material. Container **800** comprises a cap retainer **810** which completely encircles cap **803** when cap **803** is retained therein. That is, cap retainer **810** comprises a depressed region **812** but does not have spaced apart lobes. However, container **800** does comprise a single annular rim **809** upon which container **800** stands when it is in an upright orientation. Container **800** also comprises a curved surface **811** between rim **809** and depressed region **812**. When cap **803** is inserted into cap retainer **810**, projections **807** contact side surface **815** of depressed region **812** at spaced apart locations **813**. Cap **803** may deform as shown in Figure 9B. More particularly, side portion **805** of cap **803** may contract radially in the regions of projections **807** and may expand radially in the

regions between projections **807**. As shown best in Figure 9A, side portion of cap **803** may be deformed by an angle δ in the region of projection **807**. Deformation angle δ depends on a number of factors, including the material used to form cap **803** and projections **807** and the dimension of cap **803** and projections **807**. Deformation angle δ may be in the range of 0-10°. In some embodiments, for example where elastomeric material is employed, deformation angle δ may be significantly higher. In other respects, container **800** and cap **803** may be similar to the other embodiments described herein.

- Figures 10A-10B show a container **850** and a cap **853** according to another alternative embodiment of the invention. Container **850** comprises a cap retainer **860** that is substantially similar to cap retainer **110** of Figures 2A-2D, except that cap retainer **860** is located in the base **855** of container **860** and that base **856** of cap retainer **860** comprises a curved portion **856A** near its open end **858**. In other respects, container **850** and cap **853** may be similar to the other embodiments described herein.
- Figures 11A and 11B show a container **900** and a cap **903** according to another alternative embodiment of the invention. Container **900** comprises a cap retainer **910** that is substantially similar to cap retainer **210** of Figures 3A-3D, except that cap retainer **910** is located in the base **905** of container **900** and that base **916** of cap retainer **910** is flat at both of its ends, rather than having curved portion **219** near one of its open ends. In other respects, container **900** and cap **903** may be similar to the other embodiments described herein.
- The illustrated embodiments depicted above show screw on caps. In alternative embodiments of the invention, caps may comprise any type of lid, stopper, cork, seal or the like which seals a container opening. Such caps may comprise screws for engaging the rim of a container or may comprise other means for engaging the container so as to seal the container opening. For example, such caps may be "snap-on" caps which snap onto the rim of the container opening, deformable caps which fit into an interior of the rim of the container opening or may be otherwise coupleable to the container to seal the container opening.
- Container **100** shown in Figures 2A-2D and container **200** shown in Figures 3A-3D are shown as having optional additional cap retainers **106**, **206** located in a side of container walls **101**, **201** opposite that of cap retainers **110**, **210**. Those skilled in the art will appreciate that other embodiments of

the invention described herein may also be provided with optional additional cap retainers.

- Cap **303** shown in Figures 4A-4C and cap **403** shown in Figures 5A-5C comprise radially outwardly extending lips **320**, **420** and the sidewalls **314**, **315**, **414**, **415** of the slots of containers **300**, **400** comprise corresponding grooves for receiving lips **320**, **420**. Those skilled in the art will appreciate that other embodiments of the invention described herein may also be provided with caps having radially outwardly extending lips and cap retainers having contact surfaces with corresponding grooves for receiving such lips. In alternative embodiments, lips **320**, **420** need not extend around the circumference of their respective caps **303**, **403** and may comprise one or more radial projections that span an arcuate segment of the circumference of their respective caps **303**, **403**. In alternative embodiments, the contact surfaces of cap retainers may be provided with projecting lips and caps may be provided with corresponding grooves.
- Container **700** and/or cap **703** of Figures 8A-8B described above comprise a layer **711** of elastomeric material which is coated onto contact surfaces **731A** of its cap retainer **710** and/or to exterior surface **746** of the side portion **746A** of cap **703**. Those skilled in the art will appreciate that the retaining capability of the cap retainers of any of the above described embodiments may be increased by coating the contact surfaces of the cap retainer and/or the corresponding surfaces of the cap with a layer of elastomeric material. The increase in retaining capability may be due to increases in friction caused by the elastomeric coating and/or increased pressure associated with deformation of the elastomeric coating. With elastomeric coatings, the tapering angles α, β of the above described embodiments may be substantially greater because the elastomeric coatings tend increase the friction between the cap and the contact surfaces. In some embodiments, the tapering angles α, β may be as high as 20°.
- The contact surfaces of any of the cap retainers described above and/or the corresponding surfaces of the caps may be provided with friction enhancing features, such as ridges, bumps or grooves which enhance the frictional forces therebetween. Such friction enhancing features may be integrally formed with the contact surfaces of the cap retainers and/or the corresponding surfaces of the caps or may be subsequently added to the contact surfaces of the cap retainers and/or the corresponding surfaces of the

caps. The friction enhancing features may be formed from an elastomeric material.

- The embodiments described above depict beverage containers typically referred to as "bottles". The invention is particularly well suited for beverage containers, because the cap may be hygienically stored and reused to seal the container and because storage of the cap allows the user to drink from the beverage container while performing other tasks with at least one of their hands. In addition, the provision of tapering angles **α**, **β** in the embodiments described above, allows caps to be deformed most significantly in the regions of the side portions closest to their cap rims. This makes it easier to deform the caps and prevents permanent warpage and breakage of the caps. This feature is particularly useful for beverage containers which may leak if their caps are permanently warped or broken. Despite these advantages which are directly applicable to beverage containers, the invention described herein is not limited to beverage containers. Alternative embodiments of the invention provide containers for holding other fluids, semi-fluids and/or solid contents.
- Some of the above described embodiments have slot shape cap retainers having sidewalls with sidewall points and curved contact surfaces. In some embodiments, one or both of the sidewalls of slot shaped cap retainers are straight (i.e. are not provided with sidewall points or curved portions). In such embodiments, cap may be held in part by the pressure associated with deformation of the cap against a straight contact surface of the straight sidewall.
- Container **400** of Figures 5A-5C comprise a cap retainer **410** having gaps **426, 427** between its sidewall portions **414A, 414B, 415A, 415B**. The size of these gaps may be increased, such that only the corners of sidewall portions **414A, 414B, 415A, 415B** form contact surfaces which engage the cap **403**.
- In the above described embodiment, the slot-shaped cap retainers are located on the sides or on the bases of their corresponding containers. In the above-described embodiments, the slot-shaped cap retainers located on the sides of their corresponding containers are oriented such that the longitudinal axis of the slot corresponds to the longitudinal (vertical) axis of the container. This is not necessary. In general, the longitudinal axis of the slot may have any orientation with respect to the longitudinal (vertical) axis of the container.

- Cap retainers similar to cap retainers **510**, **610**, **710** may be located on the side portions of their corresponding containers.

Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.